Chapter 4
NATURAL RESOURCES

The Kissimmee Basin (KB) Planning Area contains a variety of natural resources. The wetlands, uplands, and wildlife of the KB Planning Area all have water needs and require protection.

WETLANDS

Water bodies and wetlands together cover about a quarter of the KB Planning Area. Hydrophytic vegetation, hydric soils, and hydrology typically characterize wetlands. Chapter 62-340, F.A.C. provides the statewide methodology for delineating wetlands in Florida and includes the following definition of wetlands:

> Those areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils.

Functions and Values of Wetlands

Wetlands perform a number of hydrologic and biological functions. Hydrologic functions include receiving and storing surface water runoff. This is important in controlling flooding, erosion, and sedimentation. Surface water that enters a wetland is stored until the wetland overflow capacity is reached and water is slowly released downstream. As the water is slowed by wetland vegetation, sediments in the water (and chemicals bound to the sediments) settle out of the water column, improving water quality.

Wetlands also function hydrologically as ground water recharge/discharge areas. Wetlands may recharge the ground water when the water level of a wetland is higher than the water table. Conversely, ground water discharge to wetlands may occur when the water level of the wetland is lower than the water table of the surrounding land.

Biological wetland functions include providing habitat for fish and wildlife, including organisms classified as endangered, threatened, or species of special concern. Some species depend on wetlands for their entire existence, while other semi-aquatic and terrestrial organisms use wetlands during some part of their life cycle. Their dependence on wetlands may be for over-wintering, residence, feeding and reproduction, nursery areas, den sites, or corridors for movement. Wetlands are also an important link in the aquatic food web. They are important sites for microorganisms, invertebrates and forage fish which are consumed by predators such as amphibians, reptiles, wading birds, and mammals.

Types of Wetlands

Inland or freshwater wetlands within the KB Planning Area can be grouped into three major categories based on hydroperiod: permanently flooded or irregularly exposed; seasonally or semipermanently flooded; and temporarily flooded or saturated. Uplands are also represented on the Florida Land Use, Cover and Forms Classification System (FLUCCS). The FLUCCS map was created in 1998 using 1994-1995 aerial photography and was used to delineate wetlands in the Lower West Coast Planning Area. The hydroperiod categories were created by combining FLUCCS coverage classifications with the National Wetlands Inventory hydrologic classifications. This methodology and resulting map (**Plate 4**) is being applied to the KB Water Supply Planning Area. The hydrologic categories are broadly defined as:

- **Permanently Flooded or Irregularly Exposed**. Water covers the substrate throughout the year in all years or the substrate is exposed by tides less often than daily. This category corresponds to lakes, rivers, ponds and reservoirs.
- **Seasonally or Semipermanently Flooded**. Surface water persists throughout the rainy season and much of the dry season in most years. When surface water is absent, the water table is at or very near the land surface and seasonally flooded soils remain saturated. Corresponds to swamps, sloughs, mixed wetland hardwoods, cypress, mixed wetland forest, freshwater marshes, sawgrass and or cattail, emergent and submergent aquatic vegetation.
- **Temporarily Flooded or Saturated.** Surface water is present during the rainy season, but the water table usually lies below the soil surface for most of the year. Plants that grow in both uplands and wetlands are characteristic of this regime. The substrate is saturated to the surface through out the rainy season or for extended periods of during the rainy season in most years. This category corresponds to cypress–pine–cabbage palm, wet prairie–with pine intermittent ponds, pine–mesic oak, Brazilian pepper, melaleuca, and waxed myrtle-willow.

Distribution of Wetlands

Most wetland systems in the KB Planning Area drain into the Kissimmee River, and subsequently Lake Okeechobee. Shingle Creek Swamp and Reedy Creek Swamp, two large forested wetlands in the northernmost reaches of the KB Planning Area, start the headwaters of the Kissimmee Chain of Lakes. Water from these two wetland systems flow slowly southward and drain into Lake Tohopekaliga. Outflows from Lake Tohopekaliga and the Alligator Chain of Lakes drain into Cypress Lake, which in turn flows into Lake Hatchineha and then into Lake Kissimmee. Large herbaceous marshes surround Cypress Lake, the north end of Lake Hatchineha, and the entire shoreline of Lake Kissimmee. The

Alligator Chain of Lakes is surrounded by large areas of forested cypress and mixed hardwood swamps as well as smaller pockets of herbaceous marsh.

The drainage basins within the SFWMD boundary of Polk County can be divided into the portions above and below Lake Hatchineha. Above the lake, the relatively low-lying flat prairies and shallow lake systems of Lake Marion and Saddlebag Lake drain into Lake Kissimmee. Lake Marion overflows through an extensive forested wetland system into Lake Hatchineha, which discharges to Lake Kissimmee. Saddlebag Lake flows in a northwesterly direction through a series of small lakes into Big Gum Lake, which in turn overflows into Lake Pierce and subsequently into Lake Hatchineha.

Below Lake Hatchineha there are the lake systems of Lake Weohyakapka and Arbuckle Lake. Lake Weohyakapka flows into Lake Rosalie via Weohyakapka Creek, which is surrounded by forested floodplains. Lake Rosalie then drains in a southeasterly direction into Tiger Lake, which flows into Lake Kissimmee. Arbuckle Lake drains in a southerly direction into the Kissimmee River.

Lake Istokpoga, the largest lake in Highlands County, drains into the Kissimmee River through the Istokpoga Canal and C-41A. The lake used to be surrounded by extensive wetlands, but now only has remnant marshes. Pasture now surrounds a large portion of the lake, and residential development has taken place on the southwest shore of the lake.

UPLANDS

Native uplands are non-wetland areas with intact ground cover, understory, and canopy. Native uplands in the KB Planning Area include longleaf and slash pine forests, live oak hammocks, sand pine scrub, cabbage palm, turkey oak, hardwood forest, palmetto prairies, and dry prairie grasslands. Uplands often have ground water storage available in the SAS where rainfall infiltrates the surface soils with part used by plants as evapotranspiration, and the remainder percolates to ground water storage. Ground water storage in upland areas reduces runoff during extreme rainfall events, while plant cover reduces erosion and absorbs nutrients and other pollutants that might be generated during a storm. Upland vegetative areas also provide climate moderation, noise barriers, wildlife habitat, and recreational resources.

Pine flatwoods are an important upland community in the KB Planning Area. These plant associations are characterized by a low, flat topography and poorly drained, acidic, sandy soils. Under natural conditions, fire maintains flatwoods as a stable plant association. However, when the natural frequency of fire is altered by increased drainage and the construction of roads and other fire barriers, flatwoods can succeed to other community types. The nature of this succession depends on soil characteristics, hydrology, available seed sources or other local conditions (Myers and Ewel, 1990).

The Longleaf Pine-Turkey Oak Hills ecological community occurs nowhere else in the SFWMD except in eastern Polk and northern Highlands counties. This community occurs on rolling land. Water moves rapidly through the soils. There are several variations of this community. Mature natural stands of trees have scattered longleaf pine as an overstory. Areas on which pines have been removed are predominantly oaks. Ground cover is scattered and numerous bare areas are noticeable. This community is influenced by fire, heat and drought. The natural vegetation is adapted to withstand the effects of occasional fire. Without the occurrence of fire, the longleaf pine cannot withstand the invasion of hardwood species and would change into an upland hardwood hammock. In this habitat, water moves rapidly through the soil to the aquifer with little runoff and minimal evapotranspiration (Soil and Water Conservation Society, 1989)

The Kissimmee Prairie Ecosystem is located in Okeechobee County, east of C-38. In 1998, the District and CARL purchased the entire tract. It has a total area of about 46,000 acres, of which 7,000 acres lie within the boundary of the Kissimmee River Restoration Project. The remaining 39,000 acres form one of the most unique land mosaics in Florida. This ecosystem is mostly undisturbed, and includes 10 separate community types which provide breeding habitat for numerous wildlife species. The dominant community type is dry prairie, and this tract is likely to be the largest and best example of its type in the world (SFWMD, 1999). This area has been acquired for conservation/preservation purposes.

WATER NEEDS OF INLAND RESOURCES

Wetland Water Needs and Concerns

Maintaining appropriate wetland hydrology (water levels and hydroperiod) is the single most critical factor in maintaining a viable wetland ecosystem (Duever, 1988; Mitch and Gosselink, 1986; Erwin, 1991). Rainfall, along with associated ground water and surface water inflows, is the primary source of water for the majority of wetlands in the KB Planning Area. Because wetlands exist along a continuous gradient, changes in the hydrologic regime may result in a change in the position of plant and animal communities along the gradient. The effects of hydrologic change are both complex and subtle. They are influenced by, and reflect regional processes and impacts as well as local ones (Gosselink et al., 1994). Hydrology, as well as other factors which influence wetland systems, such as fire, geology and soils, and climate, is further discussed in Appendix E.

James Gosselink states in a 1994 study on wetland protection from aquifer drawdown that a critical issue to be considered in the water supply planning process is how wellfield induced ground water drawdowns affect wetlands. An adverse environmental impact can be defined as: (1) a change in surface or shallow ground water hydrology that leads to a measurable change in the location of the boundary of a wetland; or (2) a measurable change in one or more structural components of a wetland as compared to control or reference wetlands, or to the impacted wetland before the change occurred (Gosselink et al., 1994). Lowered ground water tables in areas adjacent to wetland communities have been shown to decrease wetland surface water depths and shorten the hydroperiod (length of inundation).

Aquifer drawdown and its subsequent effect on wetlands are best measured using three parameters; severity (the depth of the drawdown), duration (the length of time), and frequency (how often that drawdown occurs). The most obvious impact of reducing hydroperiod is a decrease in the size of a wetland. This is especially true of shallow, low gradient wetlands, which may be entirely eliminated by lowered water levels. Decreased wetland size reduces the available wildlife habitat and the area of vegetation capable of nutrient assimilation. Lowered water levels and reduced hydroperiod also: (a) induce a shift in community structure towards species characteristic of drier conditions; (b) reduce rates of primary and secondary aquatic production; (c) increase the destructiveness of fire; (d) cause the subsidence of organic soils; and (e) allow for exotic plant invasion (Gosselink et al., 1994). The size of a wetland may also be reduced because of changes in hydropattern. Hydropattern or surface water flow through a wetland is equally important (letter dated November 24, 1999 from Herb Stangland Jr., Ardaman and Associates Inc., Orlando, FL).

Rivers and Floodplains

The Kissimmee River and its floodplains contain forested, wetland shrub, and marsh wetlands, and at one time meandered through the Osceola Plain. The ability of a floodplain to store and slow the movement of water is a critical water management concern. When development occurs on a floodplain, it loses its storage functions, potentially causing flooding in areas that were previously flood free. In addition to serving as a temporary water storage system, the floodplain around the Kissimmee River served as a filtration system and wildlife habitat. The floodplain helped to regulate the velocity and timing of the flood discharge by slowing the waters that spilled over the banks of the river. Pollutants and nutrients (nitrogen and phosphorus) were taken up by the floodplain vegetation before water flowed into Lake Okeechobee or seeped into the aquifer.

The floodplain was once used by a larger number of song birds, wading birds, hawks, waterfowl, shrew, mice, raccoons, squirrels, deer, turtles, otter, fish, and other species. Restoration of parts of the river to a meandering state is taking place which will restore wetland habitat values. The federally authorized (PL 102-580) Kissimmee River Restoration Project will restore over 40 square miles of the existing channelized system, including 43 continuous miles of river channel and about 27,000 acres of wetlands. The project is expected to benefit over 320 fish and wildlife species (Toth et al., 1998).

Lakes

The KB Planning Area has hundreds of lakes. A lake can be classified according to its trophic level. Oligotrophic lakes have low levels of nutrients, good water clarity, and low levels of plant and animal life. Mesotrophic lakes have moderate levels of nutrients, moderate water clarity, and a moderate amount of plants and animals. Eutrophic lakes are characterized by high levels of nutrients, reduced water clarity, and an abundance of aquatic plant and animal life. Hypereutrophic lakes are those that often have a pea soup appearance from the amount of algae in the water column, the presence of algal mats, and an overabundance of nutrients. As rotting plant material uses oxygen, aquatic animal life may die off from a lack of dissolved oxygen in the water. Eventually, the mucky bottom of the lake fills up with sediments and converts into a marsh. Eutrophication is a natural process, however, human activities can accelerate this process (cultural eutrophication).

A decrease in nutrients to the lake systems should slow eutrophication. In the 1970s the water quality in the Upper Kissimmee Basin (especially Lake Tohopekaliga) was significantly degraded by nutrients that originated from sewage treatment plants in Orlando, and from untreated nonpoint urban and agricultural sources. When the nutrient sources were identified and consequently reduced or eliminated, the water quality in the lakes improved. Better water quality in the Upper Kissimmee Basin may lead to improved quality in the Lower Kissimmee Basin and Lake Okeechobee.

Springs

There are no known documented natural springs located with in the KB Planning Area. There are anecdotal discussions with local residents of existing shallow aquifer seeps or springs located along the eastern edge of the Lake Wales Ridge in Polk County. The location of these springs has not been identified. These springs are described as small and are used for domestic use.

There are several natural springs located adjacent to, but outside the KB Planning Area. The most noteworthy of these are the springs of the Wekiva Basin, located approximately 15 miles to the north of the KB Planning Area in northwestern Orange County. These springs are the result of discharges from the FAS in areas where the confining units are thin and have been breached, allowing for the upward artesian flow of water. Discharges from seven of the springs flow to the Wekiva River, a protected Outstanding Florida Waterway. These springs include Wekiva, Sanlando, Starbuck, Miami, Rock, Palm, and Seminole springs. The St. Johns River Water Management District (SJRWMD) has determined that these springs provide an important base flow component to the river and to those vegetative communities dependant on this water. SJRWMD has determined that a 15 percent reduction in the 1995 observed spring discharge for these seven springs is enough to pose a reasonable likelihood of harm to natural systems along the Wekiva River and its tributaries. These minimum spring discharges have been set forth in Chapter 40C-8, F.A.C. This chapter also specifies specific minimum discharges for several springs located in the Wekiva Basin and throughout the SJRWMD.

The SJRWMD Water Supply Needs and Sources Assessment (1994) suggests that future withdrawals, including areas within the SFWMD may be contributing anticipated impacts to these springs. The KB Water Supply Plan Planning Document (Chapter 4) addresses this potential link between Floridan withdrawals and reduction in spring flow.

Upland Water Needs

Seasonal variations play an important role in determining the type of upland vegetation that will develop. It is general thought that plant communities located in uplands are better able to adapt to dry season hydroperiod fluctuation as compared to plants in wetlands.

Wildlife Water Needs

Appropriate hydrology is not just an issue for the plant communities, but also for the associated wildlife, including endangered and threatened species, and species of special concern (a list of endangered, threatened, and species of special concern found in the KB Planning Area is provided in Appendix E). Species composition, distribution and abundance are influenced by the annual pattern of rainfall, water level fluctuations, and fire. Alterations in ground and surface water depth and/or hydroperiod that result in changes to vegetative composition and diversity may lead to the degradation of fish and wildlife habitat.

PROTECTION OF NATURAL RESOURCES

The District protects and enhances natural resources through its wetland policies and rules, wellfield location criteria, wetland buffers, wellfield monitoring, wetland mitigation banking, and land acquisition programs.

Wetland Policies

The District prevents harm to wetlands from ground water withdrawals by implementing numerous state laws through technical criteria (Appendix A) into its consumptive use permitting process which limits drawdowns beneath wetlands. The obligation to leave enough water in natural areas to maintain their functions and protect fish and wildlife is central to water supply planning.

The State Comprehensive Plan (Chapter 187, F.S.) states as a goal that Florida "shall maintain the functions of natural systems and the overall present level of surface and ground water quality." The same document lists as a policy: "Reserve from use that water necessary to support essential non-withdrawal demands, including navigation, recreation, and the protection of fish and wildlife." Chapter 373, F.S., authorizes several means of accomplishing this goal. Some of the most noteworthy include: (1) Section 373.042 concerning minimum flows and levels; (2) Section 373.223(4) concerning reservation of water for fish and wildlife; and (3) Section 373.223 concerning the three part test for permit issuance (copies of these statutory provisions are provided in Appendix A).

The extent to which wetland preservation conflicts with water supply development depends greatly on the approach of that development. For example, options that increase water storage relieve the conflict between wetlands and human development, as does appropriate location and design of wellfields or the use of surface water. The challenge is to accept wetland protection as a constraint and then come up with the most reliable and cost-effective water supply strategy.

Wellfield Location

Locating wellfields away from wetlands is an approach that can reduce local environmental effects but is not always easy to implement. Often the choice is reduced to either locating the wellfield in undeveloped areas with environmentally sensitive wetlands or in developed uplands where the potential for wellfield contamination is a serious concern. From a planning perspective, wellfields near environmentally sensitive wetlands, should be sited in areas where leakance to the Upper Floridan aquifer is low, and not high and/or where wetlands receive runoff from a relatively large watershed as opposed to near an isolated wetland system. In developed areas, wellfields should be in areas where leakance to the Upper Floridan aquifer is low.

Wetland Buffers

Another approach involves using man-made lakes or reservoirs as a buffer between wellfields and natural wetland systems. The water in these lakes act as a buffer by managing the local water table at a sufficient level to avoid impacts to nearby wetlands. The surface water that is available in these reservoirs can also be used to supplement ground water withdrawals.

Wellfield Impact Monitoring

The District's Resource Assessment division began a research program in 1995 to support development of wetland drawdown criteria. The research project is broken down into three phases.

Phase I consisted of: (1) a literature review to determine if sufficient information is present to support existing drawdown criteria or to recommend new criteria; (2) ground water modeling; and (3) a scientific wetland expert workshop. This phase was completed in November 1995.

Phase II consisted of: (1) determining the extent and severity of impacts, if possible, using a historical approach to determine impacts from ground water drawdowns through aerial photograph interpretation; and (2) identify wetland sites throughout the District for well installation and hydrobiological monitoring. This phase was completed April 1997.

Phase III has two main objectives: (1) implement long-term hydrobiological monitoring at wetlands located along a gradient of drawdown in selected study sites; and (2) test hypotheses regarding: (a) the effects of ground water drawdowns on wet season biological productivity; (b) the dependence of surface soil moisture on the dry season water table position; (c) differences in ecosystem structure and function between wetlands subject to different amounts of drawdown; (d) the effects of local versus regional calibration of ground water models used in the permit application process; and (e) symptoms of impact observed during drought.

Site characterization and well drilling contracts are presently underway in the Lower West Coast and Kissimmee Basin water supply planning areas. Biological studies will facilitate the characterization of biotic communities of the selected wetland sites and development of non-destructive long-term monitoring methods. To date, inventories of plant, fish, aquatic insect, bird, moss, algae, and amphibian populations have been conducted. Various sampling methods are presently under investigation for incorporation into a long-term monitoring effort.

In the Lower West Coast at Flint Pen Strand, there are currently thirteen agricultural monitoring sites with sixteen associated wells, with an additional nine monitoring sites with ten associated wells. At the Stairstep project site (Corkscrew Mitigation Bank) there are three reference sites with five associated wells. These sites were outfitted with the appropriate instrumentation in December 1999. Surveying will be completed in June 2000 and complete analyses on these sites are expected in late 2000. In the Kissimmee Basin at the Disney Wilderness Preserve, there are six monitoring sites with seven associated wells and one weather station. The above wells have been monitored since the spring of 1997.

Monitoring wetlands adjacent to wellfields ensures that withdrawal impacts are detected. Steps can then be taken to limit further impacts. Long-term monitoring of wetlands adjacent to wells provides documentation of impacts to wetlands that occur over time.

The hydrologic and biologic consequences of ground water withdrawal from wellfields in the Northern Tampa Bay region have been documented by the Southwest Florida Water Management District (SWFWMD). After long-term monitoring of wells and wetland systems, SWFWMD concluded that adverse impacts are especially evident in areas where ground water modeling of withdrawals indicates a drawdown of one foot or more.

The type of impacts noted for marsh and cypress wetlands were:

- Extensive invasion of weedy upland species
- Destructive fires
- Abnormally high treefall
- Excessive soil subsidence/fissuring
- Disappearance of wetland wildlife

The SWFWMD ground water modeling has also shown that it may take one to two decades for the full effect of wellfield pumpage to be realized. Therefore, actual water levels in newer wellfields, or in wellfields currently not pumping at their maximum permitted levels, could become lower in the future. For these and other reasons, SWFWMD suggests that continued environmental monitoring will be necessary to ensure that Florida's wetlands are adequately protected (Rochow, 1994).

Wetland Mitigation Banking

Wetland mitigation banking is a relatively new natural resource management concept which provides for compensation of unavoidable wetland losses due to development. The Florida Environmental Reorganization Act of 1993 directed the water management districts and FDEP to participate in and encourage the establishment of public and private regional mitigation areas and mitigation banks. The act further directed the WMDs and FDEP to adopt rules by 1994, which led to the state's mitigation banking rule (Chapter 62-342, F.A.C.), becoming effective January 1994. In 1996, House Bill 2241 further developed this program by providing for the acceptance of monetary donation as mitigation in District and FDEP endorsed off-site regional mitigation areas. This modification clarified service area requirement credit criteria and release schedules, assurances and provisions that apply equally to public and private banks. As a result, the District and FDEP will adopt rules to implement these provisions. In the long-term, wetland mitigation banking should apply to water use permitting. Wetland mitigation banking does not currently apply to water use related impacts.

Minimum Flows and Levels

The purpose of establishing minimum flows and levels (MFLs) is to avoid diversions of water that would cause significant harm to the water resources or ecology of an area. The Florida Legislature has mandated that all water management districts establish MFLs for surface waters and aquifers within their jurisdiction. Section 373.042(1) defines the minimum flow as "the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area." It further defines the minimum level as the "level of ground water in an aquifer and the level of surface water at which further withdrawals would be harmful to the water resources of the area." The District is further directed to use the best available information in establishing a minimum flow or a minimum level.

The overall purpose of Chapter 373 is to ensure the sustainability of water resources of the state (Section 373.016, F.S.) To carry out this responsibility, Chapter 373 provides the District with several tools, with varying levels of resource protection standards. MFLs play one part in this framework. Determination of the role of MFLs and the protection that they offer, versus other water resource tools available to the District, are discussed below.

The scope and context of MFLs protection rests with the definition of significant harm. The following discussion provides some context to the MFLs statute, including the significant harm standard, in relation to other water resource protection statutes.

Sustainability is the umbrella of water resource protection standards (Section 373.016, F.S.). Each water resource protection standard must fit into a statutory niche to achieve this overall goal. Pursuant to Parts II and IV of Chapter 373, surface water management and consumptive use permitting regulatory programs must prevent **harm** to the water resource. Whereas water shortage statutes dictate that permitted water supplies must be restricted from use to prevent **serious harm** to the water resources. Other protection tools include reservation of water for fish and wildlife, or health and safety (Section 373.223(3)), and aquifer zoning to prevent undesirable uses of the ground water (Section 373.036). By contrast, MFLs are set at the point at which **significant harm** to the water resources, or ecology, would occur. The levels of harm cited above, harm, significant harm, and serious harm, are relative resource protection terms, each playing a role in the ultimate goal of achieving a sustainable water resource.

Where does the significant harm standard lie in comparison to the consumptive use permitting and water shortage standards? The plain language of the standards of harm versus significant harm, although undefined by statute, implies that the minimum flow or level criteria should consider impacts that are more severe than those addressed by the consumptive use permitting harm standard, but less severe than the impacts addressed by the serious harm water shortage standard. The conceptual relationship among the terms harm, significant harm, and serious harm are shown in **Figure 7**.

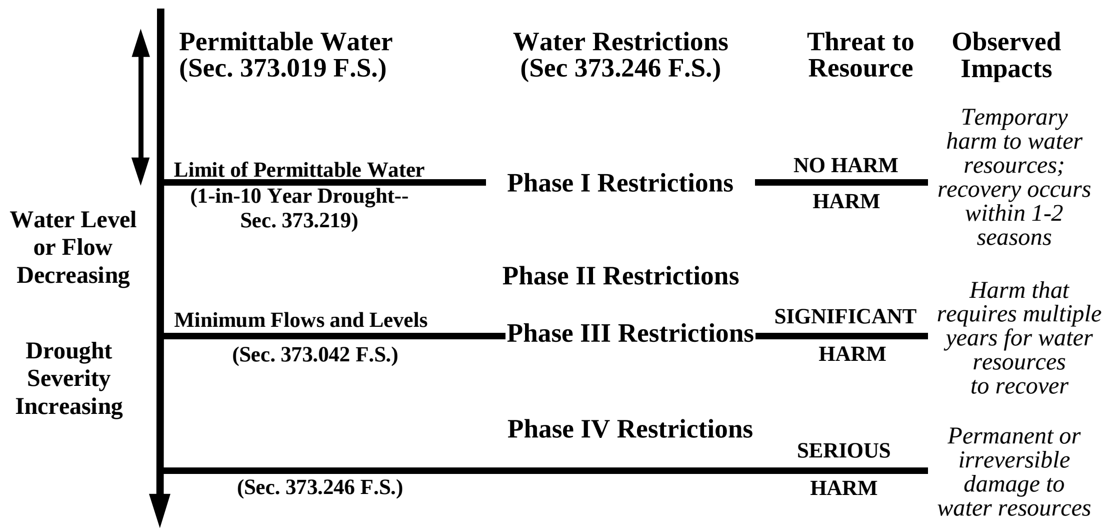

Figure 7. Conceptual Relationship among the Terms Harm, Significant Harm, and Serious Harm.

Within the KB Planning Area, 12 surface water bodies and the Floridan aquifer are on the District's priority list for establishment of MFLs. These MFLs will be established in 2004 and 2006.

Land Acquisition Programs

The ongoing acquisition efforts in the KB Planning Area include the Save Our Rivers (SOR) and the Conservation and Recreational Lands (CARL) programs.

Florida's SOR Program was started in 1981. The purpose of the SOR Program is to purchase lands necessary for water management, water supply, and the conservation and protection of water resources.

The CARL Program was established by the Florida Legislature in 1979. The primary purpose of this land acquisition program is conservation and protection of environmentally unique, irreplaceable ecological resources.